

Fall 2007 through Spring 2008



Wisconsin Department of Natural Resources
Bureau of Fisheries Management

Root River Steelhead Facility Fall 2007 and Spring 2008

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Abstract – A total of 3,547 chinook salmon, 1,169 coho salmon, 339 steelhead and 242 brown trout were examined during fall 2007 and spring 2008 at the Root River Steelhead Facility (RRSF). In fall 2007 inconsistent stream flows resulted in modest numbers of fish returning; however, we were able to obtain a good sample of all species for biological sampling. Most of the chinook and brown trout captured were passed upstream, and approximately 400,000 coho eggs were obtained at RRSF. Due to new Viral Hemorrhagic Septicemia (VHS) protocols, no skamania strain steelhead brood fish were collected. Historically, adult skamania were transported in the fall from RRSF to Kettle Moraine State Fish Hatchery, where they were held until they were ready to spawn the following January/February. VHS rules now prohibit the transfer of live fish from RRSF to a hatchery.

The spring 2008 return of steelhead was poor due to frequent high water events and unusually cold temperatures. Only 89 steelhead were spawned, which produced 96,000 eggs that were evenly split between chambers creek and ganaraska strains. Our steelhead egg-take goal was met thanks to a much better return at the Besadny Anadromous Fisheries Facility. No other salmonids were captured in the spring.

The estimated population of chinook salmon in the Root River above RRSF was 7,540 ($\pm 1,530$ SD). Population estimates for the other species were brown trout: 968 (± 593 SD), coho salmon: 2,368 ($\pm 1,450$ SD), and fall steelhead: 98 (± 0 SD). Spring population estimates were chambers creek steelhead: 336 (± 219 SD) and ganaraska steelhead: 238 (± 155 SD).

In fall 2007 at RRSF the standard weight of a 30 inch chinook salmon was 8.5 pounds and for a 22 inch coho salmon was 3.2 pounds. This is the lowest standard weight for both species since RRSF opened in fall 1994. The standard weight of a 22 inch steelhead was 3.5 pounds and a 20 inch brown trout was 3.9 pounds, both slightly below average.

The following tables and figures report the results of data collected at the RRSF during fall 2007 and spring 2008. These data contribute to a long-term index of chinook, coho and steelhead populations in the Root River, and are collected to fulfill three objectives: 1) track the abundance of salmonid returns, 2) measure growth and condition of each species and/or strain, and 3) estimate return rate of each species. For complete description of methods and calculations, see Thompson and Eggold (2007).

REFERENCES

Thompson, J. and B. Eggold. 2007. Root River Steelhead Facility, Fall 2006 and Spring 2007. Publication number PUB-FH-836 2007. Wisconsin Department of Natural Resources, Milwaukee, Wisconsin. 22 pages.

Table 1. Summary of Chinook salmon, coho salmon, steelhead and brown trout captured at the Root River Steelhead Facility during 1999 to 2008.

Harvest year	Harvested	Passed upstream	Misc. samples	Total
CHINOOK SALMON				
Fall 1999	221	5,381	420	6,022
Spring 2000	0	7	0	7
Fall 2000	244	6,965	166	7,375
Fall 2001	432	9,697	84	10,213
Spring 2002	0	1	0	1
Fall 2002	308	9,912	120	10,340
Fall 2003	0	149	0	149
Fall 2004	0	378	0	378
Fall 2005	0	3,608	15	3,623
Fall 2006	482	9,836	0	10,318
Fall 2007	15	3,501	31	3,547
COHO SALMON				
Fall 1999	154	978	18	1,150
Fall 2000	472	2,921	15	3,408
Fall 2001	314	942	71	1,327
Fall 2002	221	2,076	217	2,514
Fall 2003	0	126	72	198
Fall 2004	0	1,148	111	1,259
Fall 2005	105	657	79	841
Fall 2006	59	1,133	208	1,400
Fall 2007	249	592	328	1,169
STEELHEAD				
Spring 1999	0	2,131	132	2,263
Fall 1999	50	19	1	70
Spring 2000	0	2,107	64	2,171
Fall 2000	160	59	0	219
Spring 2001	63	790	6	859
Fall 2001	314	176	0	490
Spring 2002	0	1,180	123	1,303
Fall 2002	253	48	0	301
Spring 2003	0	977	83	1,060
Fall 2003	252	6	0	258
Spring, 2004	0	966	62	1,028
Fall 2004	296	77	0	373
Spring 2005	1	819	65	885
Fall 2005	91	25	0	116
Spring 2006	1	784	60	845
Fall 2006	340	196	0	536
Spring 2007	3	305	120	428
Fall 2007	0	98	0	98
Spring 2008	120	121	0	241
BROWN TROUT				
Fall 1999	0	125	0	125
Spring 2000	0	6	0	6
Fall 2000	2	241	0	243
Spring 2001	0	2	0	2
Fall 2001	1	176	0	177
Fall 2002	3	291	0	294
Spring 2003	0	1	0	1
Fall 2003	0	53	0	53
Spring 2004	0	3	0	3
Fall 2004	0	28	0	28
Spring 2005	0	6	0	6
Fall 2005	0	141	0	141
Spring 2006	0	1	0	1
Fall 2006	0	124	0	124
Fall 2007	0	242	0	242

Table 2. Number of Chinook salmon harvested, passed upstream and sampled at the Root River Steelhead Facility during fall 2007.

Date	Number Harvested	Number Passed Upstream	Number of Miscellaneous Samples	Total Number of Fish
27-Sep-2007	0	201	1	202
01-Oct-2007	0	690	3	693
02-Oct-2007	0	618	0	618
03-Oct-2007	0	352	0	352
04-Oct-2007	0	558	6	564
15-Oct-2007	0	516	5	521
17-Oct-2007	15	114	8	137
18-Oct-2007	0	184	0	184
23-Oct-2007	0	164	6	170
25-Oct-2007	0	46	0	46
29-Oct-2007	0	25	1	26
01-Nov-2007	0	26	1	27
05-Nov-2007	0	7	0	7
Totals	15	3,501	31	3,547

Table 3. Average weight, average length, standard weight (predicted weight at a given length based on a length-weight regression) and trophy weight (95th percentile) for the major salmonid species returning to the Root River Steelhead Facility during 1995 to 2008. The lengths used for calculation of standard weight are: 30 inches for chinook, 22 inches for coho, 22 inches for steelhead, and 20 inches for brown trout.

Season	Number used in analysis	Average weight (pounds)	Average length (inches)	Standard weight	Trophy weight
CHINOOK SALMON					
1995 – 96	443	12.0 ± 5.9	30.7 ± 5.2	10.1	21.0
1996 – 97	703	11.7 ± 5.7	30.7 ± 5.4	9.8	21.1
1997 – 98	490	12.7 ± 4.9	32.5 ± 4.4	9.5	21.1
1998 – 99	389	12.2 ± 5.0	31.9 ± 4.3	9.5	19.6
1999 – 2000	418	13.2 ± 4.4	32.5 ± 3.8	9.9	19.9
2000 – 01	536	12.3 ± 5.7	31.1 ± 5.7	9.7	20.0
2001 – 02	672	15.7 ± 5.2	34.3 ± 4.3	10.3	23.5
2002 – 03	538	13.3 ± 4.8	32.8 ± 4.7	9.4	19.9
2003 – 04	-	-	-	-	-
2004 – 05	100	7.9 ± 5.2	26.9 ± 6.3	9.0	16.2
2005 – 06	689	9.3 ± 3.5	29.8 ± 4.4	8.7	14.8
2006 – 07	650	11.7 ± 3.1	32.1 ± 2.8	9.1	17.0
2007 – 08	672	10.4 ± 3.0	31.5 ± 3.4	8.5	15.0
COHO SALMON					
1995 – 96	594	3.1 ± 2.5	19.6 ± 5.1	3.6	9.0
1996 – 97	1,273	5.1 ± 2.4	23.9 ± 4.7	3.5	8.3
1997 – 98	828	3.8 ± 1.7	21.8 ± 3.5	3.5	6.7
1998 – 99	477	4.3 ± 1.7	23.4 ± 3.1	3.4	7.5
1999 – 2000	338	7.1 ± 4.4	25.5 ± 5.9	4.0	13.5
2000 – 01	472	8.2 ± 2.5	27.3 ± 3.2	3.9	11.6
2001 – 02	316	6.8 ± 2.9	25.9 ± 4.9	3.7	10.3
2002 – 03	445	4.8 ± 1.7	23.8 ± 3.0	3.5	7.6
2003 – 04	93	5.1 ± 2.3	23.9 ± 4.7	3.7	8.2
2004 – 05	383	5.7 ± 2.1	25.6 ± 3.5	3.4	9.2
2005 – 06	680	5.4 ± 2.1	24.9 ± 3.8	3.4	8.6
2006 – 07	629	4.0 ± 2.4	22.0 ± 4.8	3.5	8.0
2007 – 08	514	4.6 ± 2.3	23.7 ± 4.8	3.2	8.1
STEELHEAD					
1995 – 96	963	6.2 ± 2.7	25.6 ± 4.3	3.7	11.0
1996 – 97	626	7.2 ± 2.4	27.4 ± 3.3	3.6	11.2
1997 – 98	522	5.8 ± 2.9	25.7 ± 4.9	3.4	11.2
1998 – 99	603	6.2 ± 2.0	25.9 ± 3.3	3.9	9.8
1999 – 2000	766	7.3 ± 2.5	27.2 ± 3.9	3.6	11.0
2000 – 01	482	5.0 ± 1.7	24.1 ± 2.7	3.7	8.4
2001 – 02	674	6.9 ± 2.4	26.9 ± 3.7	3.6	10.5
2002 – 03	526	5.3 ± 2.3	24.5 ± 4.1	3.6	9.4
2003 – 04	576	6.7 ± 2.1	26.7 ± 3.2	4.0	10.5
2004 – 05	764	5.9 ± 2.3	25.6 ± 4.0	3.6	9.5
2005 – 06	541	5.6 ± 1.5	25.4 ± 2.8	3.7	8.1
2006 – 07	771	7.2 ± 2.3	27.4 ± 3.4	3.8	11.1
2007 – 08	318	4.8 ± 2.5	23.9 ± 4.8	3.5	9.5
BROWN TROUT					
1995 – 96	201	5.3 ± 2.2	22.4 ± 3.3	3.6	9.0
1996 – 97	162	4.6 ± 2.1	21.4 ± 4.0	3.4	7.8
1997 – 98	250	6.7 ± 3.4	24.0 ± 3.7	3.8	14.1
1998 – 99	55	6.6 ± 3.2	24.3 ± 3.5	3.5	13.5
1999 – 2000	120	6.7 ± 2.6	23.9 ± 3.7	3.5	10.1
2000 – 01	0				
2001 – 02	95	5.2 ± 1.8	21.9 ± 3.1	3.7	8.2
2002 – 03	156	5.5 ± 1.6	22.5 ± 2.2	4.0	8.0
2003 – 04	44	6.3 ± 2.4	23.6 ± 2.6	4.0	11.7
2004 – 05	30	7.5 ± 3.0	25.3 ± 3.6	4.1	13.8
2005 – 06	76	6.3 ± 2.6	23.4 ± 3.2	3.3	11.8
2006 – 07	80	6.4 ± 2.7	23.7 ± 3.6	3.5	11.0
2007 – 08	60	6.3 ± 1.8	23.7 ± 1.6	3.9	8.5

Table 4. Number of Coho salmon harvested, passed upstream and sampled at the Root River Steelhead Facility during fall 2007.

Date	Number Harvested	Number Passed Upstream	Number of Miscellaneous Samples	Total Number of Fish
27-Sep-2007	0	11	0	11
01-Oct-2007	4	14	0	18
02-Oct-2007	0	0	0	0
03-Oct-2007	0	15	0	15
04-Oct-2007	3	27	0	30
15-Oct-2007	7	62	0	69
17-Oct-2007	0	4	0	4
18-Oct-2007	0	9	0	9
23-Oct-2007	88	127	157	372
25-Oct-2007	0	9	11	20
29-Oct-2007	68	70	88	226
01-Nov-2007	8	177	56	241
05-Nov-2007	71	67	16	154
Totals	249	592	328	1,169

Table 5. Estimated age composition of coho salmon (sexes combined) examined at the Root River Steelhead Facility during fall, 1995 through 2007. During 1995 to 1998, age was based on age-length key developed from known-age fin-clipped coho salmon. After 1998, ages were assigned by length-frequency of measured fish.

Year of Return	Percent age composition 1+	Percent age composition 2+	Number used in analysis	Total return
1995	24 %	76 %	1,349	3,321
1996	32 %	68 %	4,170	4,406
1997	5 %	95 %	6,978	7,894
1998	12 %	88 %	2,439	4,000
1999	44 %	56 %	341	1,150
2000	7 %	93 %	472	3,408
2001	16 %	84 %	320	1,327
2002	16%	84%	334	2,514
2003	17%	83%	93	198
2004	17%	83%	363	1,259
2005	20%	80%	680	841
2006	48%	52%	593	1,400
2007	25%	75%	514	1,169

Figure 1. Standard weight for the major salmonid species returning to the Root River Steelhead Facility during 1994 to 2007.

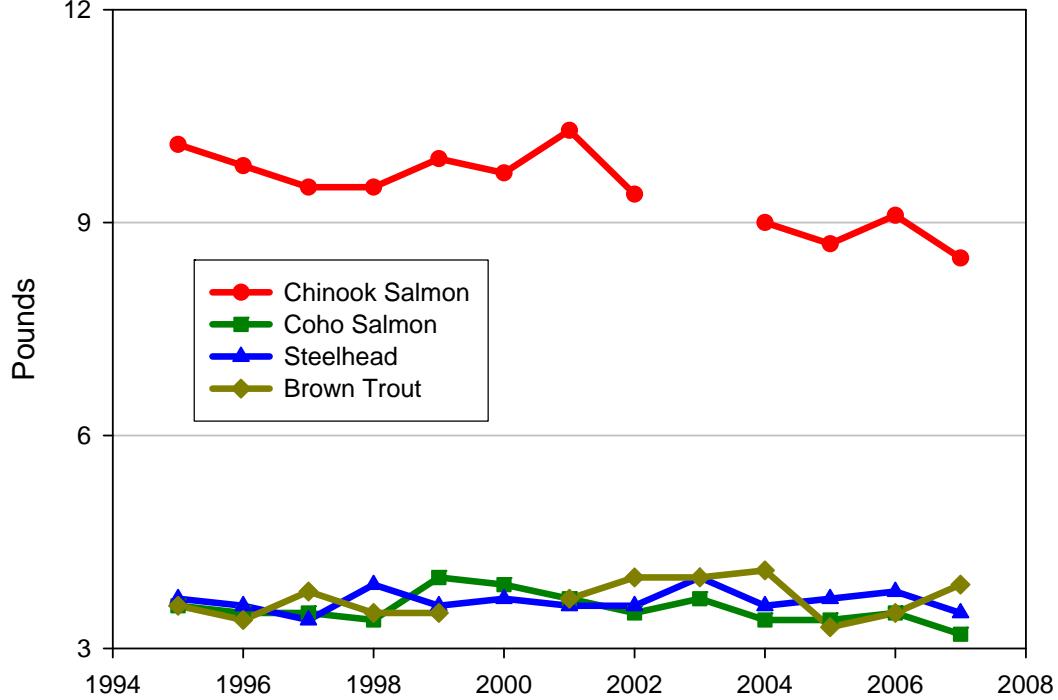


Table 6. Number of steelhead harvested, passed upstream and sampled at the Root River Steelhead Facility during fall 2007 and spring 2008.

Date	Number Harvested	Number Passed Upstream	Number of Miscellaneous Samples	Total Number of Fish
27-Sep-2007	0	12	0	12
01-Oct-2007	0	2	0	2
02-Oct-2007	0	0	0	0
03-Oct-2007	0	13	0	13
04-Oct-2007	0	2	0	2
15-Oct-2007	0	1	0	1
17-Oct-2007	0	1	0	1
18-Oct-2007	0	0	0	0
23-Oct-2007	0	42	0	42
25-Oct-2007	0	15	0	15
29-Oct-2007	0	8	0	8
01-Nov-2007	0	2	0	2
05-Nov-2007	0	0	0	0
09-Apr-2008	0	16	0	16
10-Apr-2008	76	43	0	119
24-Apr-2008	44	62	0	106
Totals	120	219	0	339

Table 7. Return rate of steelhead to the Root River Weir during 1994 through 2008. Number at age were estimated by expanding the proportion at each age in the aged sample against the return of known-strain steelhead. Fall data include only skamania; spring data combine chambers creek and ganaraska returns.

Year Class	Number Stocked	Return Time	Number at Age							Return Rate	
			Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7		
1994	37,347	fall	76	78	87	37	3	14	10	306	0.82%
	72,313	spring	0	299	534	116	133	45	1	1129	1.56%
	109,660	total	76	377	621	154	136	59	12	1435	1.31%
1995	34,254	fall	0	27	25	31	12	39	43	178	0.52%
	69,983	spring	0	25	111	807	216	19	21	1199	1.71%
	104,237	total	0	52	136	838	228	59	64	1377	1.32%
1996	35,262	fall	0	0	18	84	20	8	3	133	0.38%
	70,225	spring	0	47	850	815	10	9	0	1731	2.47%
	105,487	total	0	47	868	899	30	17	3	1864	1.73%
1997	37,484	fall	0	0	46	5	5	2	0	58	0.15%
	66,735	spring	0	38	323	61	18	6	8	455	0.68%
	104,219	total	0	38	369	66	23	8	8	513	0.49%
1998	35,528	fall	0	5	231	156	30	10	6	438	1.23%
	53,914	spring	0	122	578	723	146	19	3	1591	2.95%
	89,442	total	0	127	809	879	176	29	3	2029	2.3%
1999	37,010	fall	0	5	77	41	2	7	6	138	0.37%
	54,405	spring	0	25	245	107	15	4	2	398	0.73%
	91,415	total	0	30	322	148	17	11	8	536	0.59%
2000	35,247	fall	8	0	154	130	1	9	3	305	0.87%
	54,160	spring	0	42	403	444	100	4	13	1006	1.86%
	89,407	total	8	42	557	574	101	13	16	1311	1.47%
2001	33,634	fall	0	38	103	8	75	27	-	251	0.75%
	54,189	spring	0	100	323	376	268	76	2	1145	2.11%
	87,823	total	0	138	426	384	343	103	2	1396	1.59%
2002	35,448	fall	0	2	85	117	0	-		204	0.58%
	54,273	spring	0	12	106	129	27	4		278	0.51%
	89,721	total	0	14	191	246	27	4		482	0.54%
2003	35,145	fall	0	0	268	4	-			272	0.77%
	58,920	spring	0	101	270	97	18			468	0.79%
	94,065	total	0	101	538	101	18			758	0.80%
2004	35,930	fall	0	3	29	-				32	0.08%
	55,033	spring	0	30	73	18				121	0.22%
	90,963	total	0	33	102	18				153	0.17%
2005	34,452	fall	0	3	-					3	0.00%
	54,346	spring	0	60	90					150	0.28%
	88,798	total	0	63	90					153	0.17%
2006	35,210	fall	0	-						0	0.00%
	57,934	spring	0	67						67	0.12%
	93,144	total	0	67						67	0.07%

Table 8. Estimated age composition of steelhead (sexes combined) examined at the Root River Steelhead Facility during 1994 – 2008. Age is based on age-length key developed from known-age fin clipped steelhead. Total number represents the number of steelhead used in the analysis.

Year of return		Percent age composition						Total Number
	1+	2+	3+	4+	5+	6+	7+	
Fall – 1994	8.9	7.5	43.2	34.2	6.2	-	-	146
Spring – 1995		7.3	31.3	38.0	12.7	10.7	-	450
Fall – 1995	15.6	12.2	21.8	49.7	0.7	-	-	147
Spring – 1996		11.0	36.1	33.1	9.1	10.1	0.6	692
Fall – 1996	-	26.3	36.8	5.3	31.6	-	-	21
Spring – 1997		1.0	22.1	42.5	22.5	10.5	1.4	483
Fall – 1997	-	4.4	14.2	67.2	9.6	4.4	-	135
Spring – 1998		15.3	35.9	37.6	5.6	5.2	0.4	287
Fall – 1998	-	-	29.3	44.0	25.3	1.4	-	75
Spring – 1999		2.1	46.5	44.2	7.3	-	-	385
Fall – 1999	-	-	32.3	54.7	5.2	7.8	-	51
Spring – 2000		8.0	21.3	53.6	14.2	3.0	-	714
Fall – 2000	-	2.7	25.3	46.7	6.7	8.0	10.7	75
Spring – 2001		3.5	83.2	8.9	1.4	2.8	0.2	482
Fall – 2001	2.4	1.4	72.8	1.5	13.3	26.3	7.0	212
Spring – 2002		4.2	23.2	68.3	1.5	0.8	2.0	575
Fall – 2002	-	-	26.8	53.9	1.7	2.7	14.8	278
Spring – 2003		13.1	52.9	14.1	19.2	0.8	-	491
Fall – 2003	-	14.1	57.6	15.3	11.1	0.8	1.1	262
Spring – 2004		1.5	39.2	54.0	1.8	2.3	1.0	385
Fall – 2004	-	0.8	41.6	52.8	0.8	4.0	-	125
Spring – 2005		14.7	15.3	54.5	14.5	0.6	0.4	490
Fall – 2005	-	-	79.8	7.3	0.1	6.4	5.5	109
Spring – 2006		4.2	38.4	18.4	38.1	0.6	0.3	354
Fall – 2006	-	0.6	55.6	24.2	15.6	1.9	1.3	475
Spring – 2007		17.4	21.1	28.0	7.8	22.0	3.7	218
Fall – 2007	-	4.8	43.5	6.5	-	40.4	4.8	62
Spring – 2008		34.6	46.2	9.3	6.6	2.2	1.1	182

Table 9. Average length and weight at age (\pm 1 SD) of fall-run skamania-strain steelhead at the Root River Steelhead Facility during 1994 to 2007. Data from 2000 - 2004 were taken from fish transported and held at Kettle Moraine Springs Hatchery, so some weight loss likely occurred.

Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Fall, 1994	Skamania	23.6 (\pm 0) 4.5 (\pm 0) N = 1	26.1 (\pm 1.8) 5.6 (\pm 1.1) N = 52 / 43	29.9 (\pm 1.8) 8.3 (\pm 1.5) len N = 40	31.9 (\pm 2.7) 10.2 (\pm 2.2) len N = 13	33.6 (\pm 1.0) 11.6 (\pm 1.3) N = 11 wt N = 31 wt N = 12	
Fall, 1995	Skamania	25.8 (\pm 1.0) 5.3 (\pm 0.8) N = 14	27.0 (\pm 1.5) 6.2 (\pm 1.1) N = 27	30.5 (\pm 2.0) 9.1 (\pm 2.1) N = 70	31.7 (\pm 1.1) 10.5 (\pm 1.4) N = 6		
Fall, 1996	Skamania	22.1 (\pm 0) 4.0 (\pm 0) N = 1	27.2 (\pm 1.4) 6.7 (\pm 0.7) N = 7	28.8 (\pm 0) 8.0 (\pm 0) N = 1	32.1 (\pm 1.7) 10.1 (\pm 1.8) N = 2		
Fall, 1997	Skamania	28.5 (\pm 1.0) 7.1 (\pm 0.9) N = 6	27.1 (\pm 1.1) 6.0 (\pm 1.0) len N = 19	31.1 (\pm 1.8) 9.1 (\pm 1.9) N = 91	32.1 (\pm 1.3) 9.6 (\pm 1.1) N = 12	34.5 (\pm 1.7) 12.3 (\pm 3.3) N = 7	36.0 (\pm 0) 12.9 (\pm 0) N = 1
Fall, 1998	Skamania			25.8 (\pm 1.4) 5.1 (\pm 0.8) N = 22	30.0 (\pm 2.1) 8.0 (\pm 1.6) N = 44	31.9 (\pm 2.0) 9.5 (\pm 1.5) N = 19	
Fall, 1999	Skamania			28.3 (\pm 1.6) 7.3 (\pm 0.8) N = 14	29.0 (\pm 1.2) 8.0 (\pm 1.1) N = 25	31.6 (\pm 2.1) 10.6 (\pm 0.4) N = 2	32.2 (\pm 0.6) 10.0 (\pm 1.1) N = 4
Fall, 2000	Skamania	26.4 (\pm 0) 7.0 (\pm 1.4) N = 2	27.8 (\pm 1.2) 7.5 (\pm 1.0) N = 19	30.2 (\pm 2.0) 8.5 (\pm 2.0) len N = 37	28.9 (\pm 0.5) 8.6 (\pm 1.0) N = 8	31.2 (\pm 1.0) 10.6 (\pm 1.8) N = 6	32.3 (\pm 2.3) 10.1 (\pm 1.8) N = 8
Fall, 2001	Skamania			27.0 (\pm 1.3) 6.8 (\pm 1.1) len N = 135	25.5 (\pm 0.6) 6.6 (\pm 0.2) len N = 3	31.5 (\pm 1.4) 9.3 (\pm 1.5) len N = 5	30.5 (\pm 1.1) 10.1 (\pm 1.9) len N = 15
Fall, 2002	Skamania			wt N = 53	wt N = 2	wt N = 3	wt N = 10 wt N = 5
Fall, 2003	Skamania	26.6 (\pm 1.4) 6.2 (\pm 1.4) len N = 69	28.7 (\pm 1.6) 8.0 (\pm 1.3) len N = 132	30.0 (\pm 0.9) 7.3 len N = 4	30.3 (\pm 0.7) 7.8 (\pm 1.1) len N = 6	32.2 (\pm 0.9) 10.4 (\pm 1.1) len N = 31	
Fall, 2004	Skamania	25.4 (\pm 1.6) 6.3 (\pm 1.7) N = 10	26.1 (\pm 1.9) 6.4 (\pm 1.2) N = 66	29.5 (\pm 1.4) 8.6 (\pm 1.0) N = 16	32.1 (\pm 2.4) 10.9 (\pm 1.8) N = 17	30.7 7.5 N = 1	
Fall, 2005	Skamania	24.0 (\pm 0) 4.4 (\pm 0) N=1	26.3 (\pm 2.1) 6.2 (\pm 1.3) N=52	29.2 (\pm 1.7) 7.9 (\pm 1.5) N=66	31.8 (\pm 0) 10.1 (\pm 0) N=1	32.5 (\pm 2.6) 10.0 (\pm 1.6) N=5	
Fall, 2006	Skamania	27.3 (\pm .6) 6.0 (\pm 1.5) N=4	27.3 (\pm 1.2) 7.0 (\pm 1.0) N=262	30.2 (\pm 1.7) 9.4 (\pm 1.8) N=114	29.7 (\pm 1.4) 8.7 (\pm 1.6) N=81		32.0 (\pm 1.0) 11.6 (\pm 1.3) N=6
Fall, 2007	Skamania		27.5(\pm 0.9) 6.2 (\pm 1.2) N=28	27.0 (\pm 1.5) 7.2 (\pm 2.2) N=5		31.7 (\pm 1.2) 9.2 (\pm 1.4) N=27	30.2 (\pm 0.3) 9.0 (\pm 0.8) N=3

Table 10. Average length and weight at age (\pm 1 SD) of spring-run chambers creek-strain steelhead at the Root River Steelhead Facility during 1995 to 2008.

Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Spring, 1995	Chambers Cr.	20.9 (\pm 1.1)	23.9 (\pm 1.7)	28.1 (\pm 1.4)	28.5 (\pm 1.4)	31.3 (\pm 0.9)	
		4.2 (\pm 1.1)	4.6 (\pm 1.1)	7.6 (\pm 1.2)	7.8 (\pm 1.3)	10.0 (\pm 1.1)	
		N = 3	N = 73	N = 89	N = 32	N = 25	
Spring, 1996	Chambers Cr.	18.5 (\pm 0.8)	25.2 (\pm 1.4)	27.9 (\pm 1.4)	29.5 (\pm 1.8)	31.2 (\pm 1.3)	32.0 (\pm 0.6)
		2.2 (\pm 0.3)	5.6 (\pm 1.1)	7.4 (\pm 1.2)	9.3 (\pm 1.6)	10.5 (\pm 1.5)	12.0 (\pm 0.7)
		N = 22	N = 87	N = 90	N = 52	N = 41	N = 3
Spring, 1997	Chambers Cr.		24.8 (\pm 1.3)	28.6 (\pm 1.9)	27.4 (\pm 1.6)	32.2 (\pm 1.1)	
			5.3 (\pm 1.0)	8.3 (\pm 1.5)	6.6 (\pm 1.5)	11.2 (\pm 1.6)	
			N = 33	N = 77	N = 70	N = 35	
Spring, 1998	Chambers Cr.		23.8 (\pm 1.4)	27.7 (\pm 2.3)	28.9 (\pm 1.8)	32.1 (\pm 0.8)	
			4.3 (\pm 0.8)	7.0 (\pm 2.0)	7.5 (\pm 1.2)	10.2 (\pm 1.3)	
			N = 42	N = 39	N = 5	N = 7	
Spring, 1999	Chambers Cr.	18.6 (\pm 0.4)	23.8 (\pm 1.6)	28.3 (\pm 2.0)	28.6 (\pm 2.3)		
		2.7 (\pm 0.8)	4.7 (\pm 0.8)	7.6 (\pm 1.3)	8.0 (\pm 1.8)		
		N = 2	N = 13	N = 96	N = 4		
Spring, 2000	Chambers Cr.	17.2 (\pm 1.1)	26.2 (\pm 1.8)	29.3 (\pm 1.8)	29.8 (\pm 2.2)	30.3 (\pm 1.5)	
		1.6 (\pm 0.3)	6.3 (\pm 1.1)	8.3 (\pm 1.4)	8.7 (\pm 1.8)	8.6 (\pm 1.9)	
		N = 12	N = 26	N = 90	N = 54	N = 8	
Spring, 2001	Chambers Cr.		23.9 (\pm 1.6)	27.5 (\pm 3.3)	31.3 (\pm 0)	27.8 (\pm 0.4)	
			4.7 (\pm 0.8)	6.9 (\pm 2.0)	10.7 (\pm 0)	7.1 (\pm 0.5)	
			N = 62	N = 8	N = 1	N = 4	
Spring, 2002	Chambers Cr.		25.5 (\pm 1.8)	28.9 (\pm 1.8)	30.3 (\pm 2.4)	29.9 (\pm 2.3)	32.3 (\pm 1.3)
			5.4 (\pm 1.1)	8.0 (\pm 1.6)	9.8 (\pm 1.4)	8.7 (\pm 1.6)	11.2 (\pm 1.8)
			N = 17	N = 206	N = 2	N = 2	N = 8
Spring, 2003	Chambers Cr.	16.9 (\pm 1.4)	24.8 (\pm 1.3)	28.2 (\pm 1.5)	28.8 (\pm 2.2)	28.6 (\pm .7)	
		1.8 (\pm .4)	5.1 (\pm 1.0)	7.4 (\pm 1.3)	7.7 (\pm 1.5)	7.1 (\pm .4)	
		N = 20	N = 72	N = 27	N = 19	N = 2	
Spring, 2004	Chambers Cr.	16.5 (\pm 1.8)	24.8 (\pm 1.4)	28.6 (\pm 1.8)		31.1 (\pm 1.6)	32.6 (\pm .7)
		1.6 (\pm .4)	5.4 (\pm .9)	7.9 (\pm 1.5)		9.7 (\pm 1.4)	11.0 (\pm .7)
		N = 3	N = 48	N = 112		N = 5	N = 4
Spring, 2005	Chambers Cr.	17.7 (\pm 1.2)	24.3 (\pm 1.1)	27.6 (\pm 1.9)	29.2 (\pm 2.2)	28.9 (\pm 1.7)	
		1.9 (\pm .3)	4.9 (\pm .8)	7.1 (\pm 1.6)	8.1 (\pm 1.9)	7.8 (\pm .7)	
		N = 6	N = 38	N = 81	N = 21	N = 3	
Spring, 2006	Chambers Cr.	17.9 (\pm .7)	23.5 (\pm 1.4)	27.1 (\pm 1.5)	25.5 (\pm 1.2)		32.4 (\pm 0)
		2.1 (\pm .3)	4.8 (\pm .9)	6.6 (\pm 1.0)	5.6 (\pm .9)		9.5 (\pm 0)
		N = 5	N = 22	N = 49	N = 115		N = 1
Spring 2007	Chambers Cr.	18.0 (\pm 1.0)	25.8 (\pm 1.3)	26.8 (\pm 1.1)	27.8 (\pm 1.2)	29.6 (\pm 1.0)	29.7 (\pm .8)
		2.0 (\pm 0.4)	5.6 (\pm 1.0)	6.5 (\pm 0.9)	7.1 (\pm 0.5)	8.2 (\pm 1.0)	8.5 (\pm 1.8)
		N=29	N=14	N=34	N=7	N=55	N=2
Spring 2008	Chambers Cr.	18.0 (\pm 1.0)	23.9 (\pm 1.5)	28.5 (\pm 1.9)	25.2 (\pm 2.2)		30.8 (\pm 0.5)
		2.1 (\pm 0.9)	4.4 (\pm 0.7)	7.2 (\pm 1.3)	5.3 (\pm 1.3)		7.7 (\pm 1.1)
		N=21	N=61	N=13	N=4		N=2

Table 11. Average length and weight at age (\pm 1 SD) of spring-run ganaraska-strain steelhead at the Root River Steelhead Facility during 1995 to 2008.

Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Spring, 1995	Ganaraska	16.5 (\pm 1.3) 1.5 (\pm 0.5) N = 30	21.5 (\pm 2.3) 3.3 (\pm 1.0) len N = 68	24.2 (\pm 2.2) 5.0 (\pm 1.4) N = 81	27.5 (\pm 1.7) 7.2 (\pm 2.0) N = 24	28.8 (\pm 1.2) 8.0 (\pm 1.4) N = 23	32.5 (\pm 0) 12.5 (\pm 0) N = 1
				wt N = 67			
Spring, 1996	Ganaraska	16.6 (\pm 1.9) 1.7 (\pm 0.5) N = 57	23.5 (\pm 1.8) 4.7 (\pm 1.2) N = 167	25.1 (\pm 2.0) 5.7 (\pm 1.4) N = 113	26.7 (\pm 1.9) 7.1 (\pm 1.5) N = 22	28.6 (\pm 1.5) 8.7 (\pm 1.5) N = 29	32.2 (\pm 0) 12.5 (\pm 0) N = 1
Spring, 1997	Ganaraska	15.1 (\pm 1.9) 1.2 (\pm 0.4) N = 3	23.5 (\pm 2.1) 4.3 (\pm 1.3) N = 75	28.4 (\pm 1.9) 7.9 (\pm 1.6) N = 125	27.7 (\pm 2.1) 7.4 (\pm 1.7) N = 30	27.1 (\pm 0) 6.7 (\pm 0) N = 1	
Spring, 1998	Ganaraska	16.7 (\pm 1.3) 1.6 (\pm 0.3) N = 45	21.4 (\pm 1.9) 3.3 (\pm 0.8) N = 66	25.1 (\pm 2.6) 5.2 (\pm 1.5) N = 94	27.0 (\pm 0.8) 5.9 (\pm 0.6) N = 7	31.2 (\pm 0.2) 9.3 (\pm 0.7) N = 3	30.4 (\pm 0) 4.9 (\pm 0) N = 1
Spring, 1999	Ganaraska	17.1 (\pm 1.6) 2.0 (\pm 0.6) N = 6	23.7 (\pm 1.4) 4.9 (\pm 0.9) N = 167	26.2 (\pm 1.7) 6.6 (\pm 1.3) N = 79	27.6 (\pm 2.0) 7.4 (\pm 1.8) N = 25		
Spring, 2000	Ganaraska	16.8 (\pm 1.6) 1.6 (\pm 0.4) N = 37	25.1 (\pm 2.2) 5.8 (\pm 1.6) N = 73	28.6 (\pm 2.1) 8.3 (\pm 1.9) N = 202	28.3 (\pm 2.3) 8.2 (\pm 2.1) N = 18	29.4 (\pm 1.7) 9.0 (\pm 1.1) N = 5	
Spring, 2001	Ganaraska	16.9 (\pm 0.6) 1.6 (\pm 0.3) N = 14	23.7 (\pm 1.5) 4.7 (\pm 0.8) N = 273	27.1 (\pm 2.4) 7.0 (\pm 2.1) N = 18	29.3 (\pm 1.0) 9.0 (\pm 0.6) N = 3	28.9 (\pm 1.3) 8.7 (\pm 1.7) N = 4	32.8 (\pm 0) 12.5 (\pm 0) N = 1
Spring, 2002	Ganaraska	16.0 (\pm 1.6) 1.5 (\pm 0.4) N = 17	23.2 (\pm 1.5) 4.2 (\pm 0.7) N = 86	27.3 (\pm 1.7) 7.1 (\pm 1.4) N = 103	28.1 (\pm 2.4) 8.0 (\pm 2.5) N = 5	28.9 (\pm 0.5) 8.1 (\pm 0.2) N = 2	
Spring, 2003	Ganaraska	17.0 (\pm 1.3) 1.9 (\pm .8) N = 39	22.8 (\pm 1.7) 4.3 (\pm 1.0) N = 116	27.2 (\pm 2.0) 6.5 (\pm 1.3) N = 23	25.4 (\pm 2.2) 5.8 (\pm 1.7) N = 48		
Spring, 2004	Ganaraska	15.6 (\pm 3.3) 1.6 (\pm 1.0) N = 3	23.7 (\pm 1.7) 4.8 (\pm 1.0) N = 103	27.2 (\pm 2.1) 7.1 (\pm 1.5) N = 96	28.4 (\pm 1.5) 8.1 (\pm 1.1) N = 7	30.2 (\pm .8) 8.8 (\pm .6) N = 4	
Spring, 2005	Ganaraska	17.3 (\pm 1.8) 2.0 (\pm .6) N = 66	22.7 (\pm 2.2) 4.1 (\pm 1.2) N = 37	26.4 (\pm 1.7) 6.2 (\pm 1.2) N = 186	27.7 (\pm 2.0) 7.1 (\pm 1.6) N = 50		32.6 (\pm 2.0) 10.3 (\pm .6) N = 2
Spring, 2006	Ganaraska	16.5 (\pm 1.5) 1.6 (\pm .5) N = 8	23.8 (\pm 1.9) 4.7 (\pm .9) N = 116	24.8 (\pm 1.2) 5.0 (\pm 1.3) N = 3	26.7 (\pm 1.8) 6.0 (\pm 1.3) N = 20	28.9 (\pm .5) 7.1 (\pm 1.3) N = 2	
Spring 2007	Ganaraska	18.2 (\pm 3.6) 2.2 (\pm 1.3) N = 8	23.6 (\pm 1.7) 4.6 (\pm 0.9) N = 34	26.2 (\pm 1.9) 6.3 (\pm 1.4) N = 28	28.3 (\pm 3.0) 7.6 (\pm 2.6) N = 3	27.8 (\pm 0.5) 6.6 (\pm 0.5) N = 2	30.1 (\pm 1.6) 8.3 (\pm 1.7) N = 6
Spring 2008	Ganaraska	17.3 (\pm 1.0) 1.8 (\pm 0.3) N = 45	23.0 (\pm 1.1) 4.1 (\pm 0.6) N = 22	24.9 (\pm 1.0) 5.6 (\pm 0.6) N = 3	27.2 (\pm 1.5) 6.3 (\pm 1.0) N = 8	26.6 (\pm 1.0) 5.5 (\pm 2.5) N = 2	

Table 12. Population estimates for chinook, coho and steelhead salmon returning to the Root River during fall 1999 through spring 2008. Fall steelhead are mostly skamania, but may include other strains.

Year	Species	# marked fish	# recaptured fish	# marked fish in recapture sample	Population size (±) 1 SD
Fall, 1999	Chinook	5,381	18	7	$13,836 \pm 4,088$
	Coho	978	111	35	$3,101 \pm 434$
	Fall steelhead	19	13	0	266 ± 181
	Brown	125	17	2	750 ± 342
Spring, 2000	Chambers Creek	460	1	0	-
	Ganaraska	1,006	21	13	$1,625 \pm 278$
Fall, 2000	Chinook	6,965	72	13	$38,575 \pm 9,685$
	Coho	2,921	38	11	$10,091 \pm 2,565$
	Fall steelhead	59	16	6	157 ± 51
	Brown	241	22	1	$2,771 \pm 1,529$
Spring, 2001	Chambers Creek	128	8	2	384 ± 157
	Ganaraska	475	27	6	$2,137 \pm 769$
Fall, 2001	Chinook	9,697	142	82	$16,792 \pm 1,205$
	Coho	942	2	1	$1,413 \pm 471$
	Fall steelhead	175	40	3	$1,794 \pm 762$
	Brown	176	71	1	$6,336 \pm 3,607$
Spring, 2002	Chambers Creek	564	15	9	940 ± 198
	Ganaraska	372	14	9	579 ± 115
Fall, 2002	Chinook	9,912	178	143	$12,338 \pm 458$
	Coho	2,079	109	38	$5,963 \pm 781$
	Fall Steelhead	48	5	3	72 ± 19
	Brown	291	11	6	534 ± 147
Spring, 2003	Chambers Creek	185	8	7	211 ± 28
	Ganaraska	497	19	11	858 ± 168
Fall, 2003	Chinook	149	6	5	179 ± 33
	Coho	126	4	3	168 ± 48
	Fall steelhead	6	23	0	144 ± 100
	Brown	53	25	2	663 ± 449
Spring, 2004	Chambers Creek	350	20	7	$1,000 \pm 305$
	Ganaraska	421	32	5	$2,694 \pm 1,107$
Fall, 2004	Chinook	378	4	1	$1,512 \pm 1,309$
	Coho	1,148	11	10	$1,263 \pm 120$
	Fall steelhead	77	4	3	103 ± 30
	Brown	28	9	0	280 ± 188
Spring, 2005	Chambers Creek	224	7	6	261 ± 40
	Ganaraska	388	9	7	499 ± 89
Fall, 2005	Chinook	3,608	50	25	$7,216 \pm 1,020$
	Coho	657	3	3	657 ± 0
	Fall steelhead	25	6	0	175 ± 115
	Brown	141	6	0	987 ± 646
Spring, 2006	Chambers Creek	321	18	6	963 ± 321
	Ganaraska	321	8	3	856 ± 391
Fall, 2006	Chinook	9,836	119	29	$40,362 \pm 6,518$
	Coho	1,133	3	2	$1,511 \pm 378$
	Fall steelhead	125	14	1	938 ± 504
	Brown	124	15	0	$1,984 \pm 1,358$
Spring, 2007	Chambers Creek	139	13	1	973 ± 520
	Ganaraska	65	6	0	455 ± 298
	Spring Skamania	17	2	0	51 ± 29
Fall, 2007	Chinook	3,501	28	13	$7,540 \pm 1,530$
	Coho	592	3	0	$2,368 \pm 1,450$
	Fall steelhead	98	1	1	98 ± 0
	Brown	242	3	0	968 ± 593
Spring, 2008	Chambers Creek	48	6	0	336 ± 219
	Ganaraska	34	6	0	238 ± 155
	Spring Skamania	6	2	0	18 ± 10

Figure 2. Steelhead mean length-at-age at the Root River Steelhead Facility during 1995 to 2008. Skamania data from 2001 - 2004 were taken from fish transported and held at Kettle Moraine Springs Hatchery.

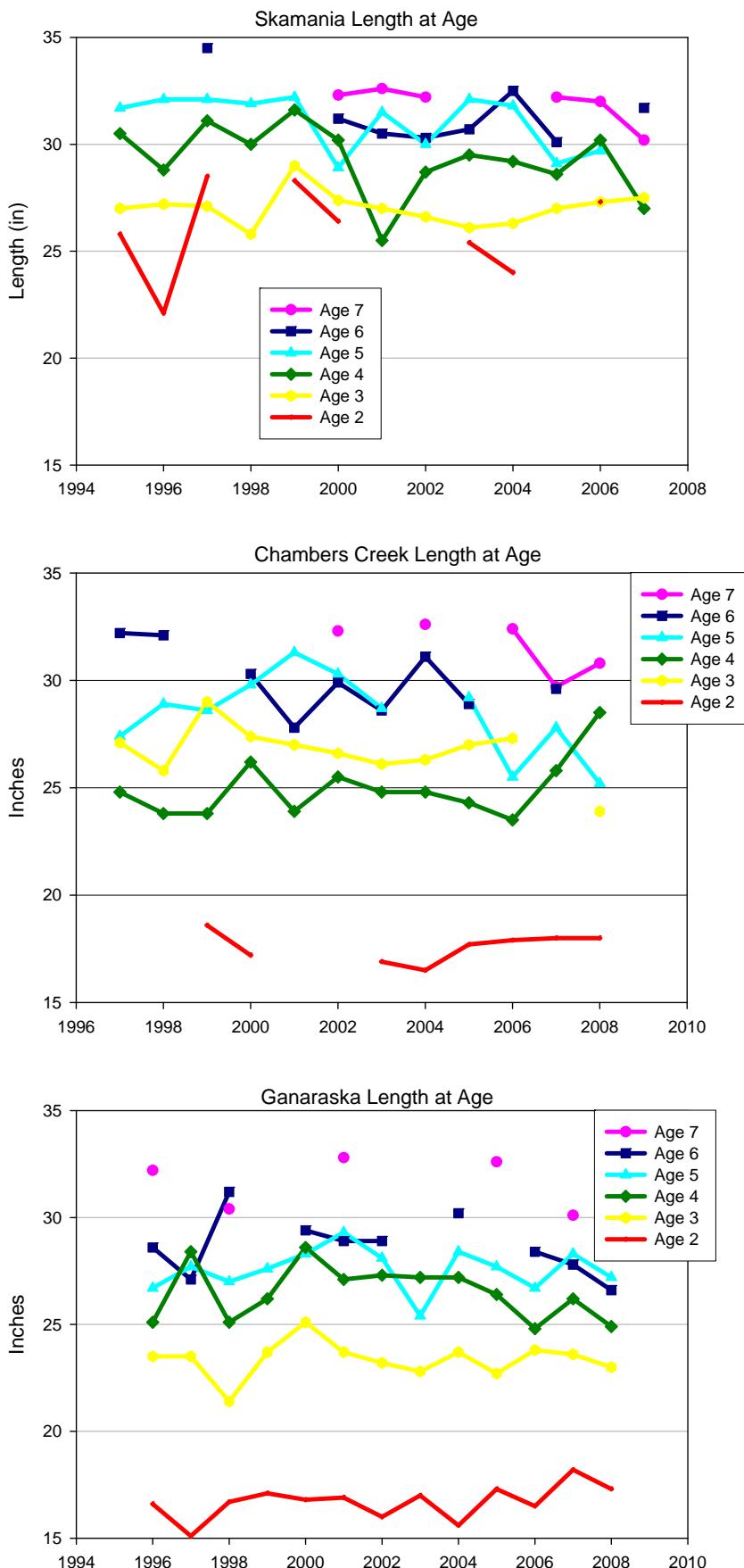
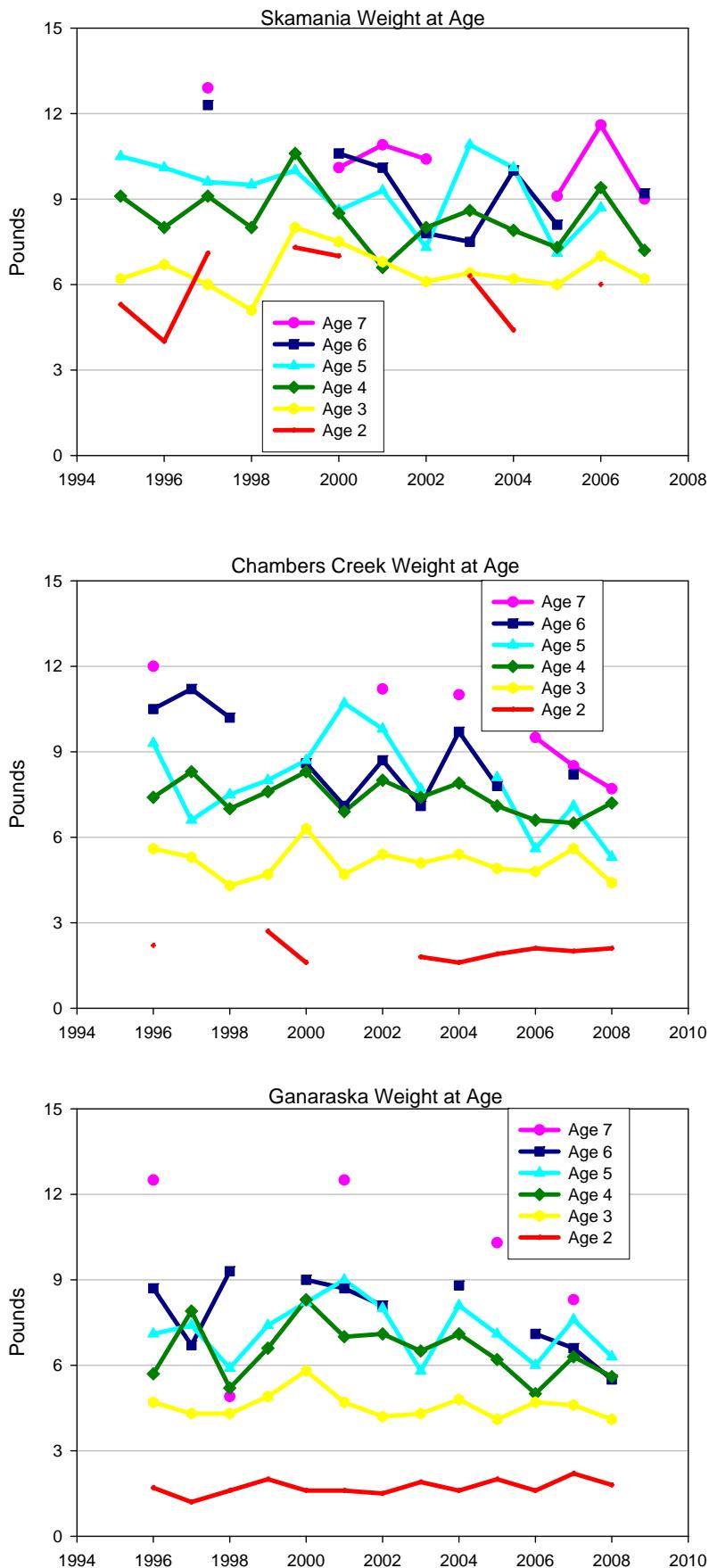


Figure 3. Steelhead mean weight-at-age at the Root River Steelhead Facility during 1995 to 2008. Skamania data from 2001- 2003 were taken from fish transported and held at Kettle Moraine Springs Hatchery.



APPENDIX A. ROOT RIVER STOCKING NUMBERS

Table A-1. Number of fingerling chinook salmon stocked in the Root River during 1994 - 2008. Chinook salmon were marked with an oral dose of Oxytetracycline (OTC) during 2001 and 2006 - 2008. Totals for 1999 and 2006 represent reductions in statewide stocking quotas, and the total for 2007 represents a reallocation to decrease chinook stocking by 33,000 in the Root River in order to increase coho by 33,000.

Year stocked	Total number	Strain	Fin clip
1994	75,533	Lake Michigan	LP
	60,000	Lake Michigan	None
1995	99,000	Lake Michigan	RP
	69,250	Lake Michigan	None
1996	158,000	Lake Michigan	None
1997	142,500	Lake Michigan	None
1998	161,500	Lake Michigan	None
1999	143,100	Lake Michigan	None
2000	142,900	Lake Michigan	None
2001	143,973	Lake Michigan	None (OTC)
2002	140,280	Lake Michigan	None
2003	143,935	Lake Michigan	None
2004	143,900	Lake Michigan	None
2005	144,035	Lake Michigan	None
2006	113,945	Lake Michigan	None (OTC)
2007	80,972	Lake Michigan	None (OTC)
2008	69,000	Lake Michigan	None (OTC)

Table A-2. Number of coho salmon stocked in the Root River during 1994 – 2008. Targets were 40,600 spring yearlings and 10,000 fall fingerlings. In 2007 target was changed to 73,600 spring yearlings and 10,000 fall fingerlings.

Year stocked	Total number	Strain	Fin clip	Age
1994	66,080	Lake Ontario	None	Spring yearling 1+
	55,954	Lake Ontario	RMLP	Fall fingerling 0+
	50,389	Lake Michigan	RP	Spring yearling 1+
1995	65,100	Lake Michigan	RMRP	Spring yearling 1+
	54,832	Lake Michigan	RMLV	Fall fingerling 0+
1996	40,590	Lake Michigan	RMRV	Spring yearling 1+
	63,697	Lake Michigan	LP	Fall fingerling 0+
1997	48,107	Lake Michigan	RP	Spring yearling 1+
	6,668	Lake Michigan	REL	Spring yearling 1+
	4,208	Lake Michigan	None	Spring yearling 1+
	20,604	Lake Michigan	None	Fall fingerling 0+
1998	33,666	Lake Michigan	None	Spring yearling 1+
	10,000	Lake Michigan	None	Fall fingerling 0+
1999	45,945	Lake Michigan	None	Spring yearling 1+
	13,824	Lake Michigan	None	Fall fingerling 0+
2000	41,375	Lake Michigan	None	Spring yearling 1+
	10,030	Lake Michigan	None	Fall fingerling 0+
2001	27,970	Lake Michigan	None	Spring yearling 1+
	11,080	Lake Michigan	A-CWT	Spring yearling 1+
	10,260	Lake Michigan	None	Fall fingerling 0+
2002	29,954	Lake Michigan	None	Spring yearling 1+
	10,648	Lake Michigan	A-CWT	Spring yearling 1+
	12,285	Lake Michigan	None	Fall fingerling 0+
2003	31,514	Lake Michigan	None	Spring yearling 1+
	10,845	Lake Michigan	A-CWT	Spring yearling 1+
2004	40,623	Lake Michigan	None	Spring yearling 1+
	14,500	Lake Ontario	None	Fall fingerling 0+
2005	9,755	Lake Ontario	A-CWT	Spring yearling 1+
	30,855	Lake Ontario	None	Spring yearling 1+
	12,739	Lake Michigan	None	Fall fingerling 0+
2006	36,510	Lake Michigan	None	Spring yearling 1+
	7,560	Lake Michigan	A-CWT	Spring yearling 1+
	10,000	Lake Michigan	None	Fall fingerling 0+
2007	61,888	Lake Michigan	None	Spring yearling 1+
	10,000	Lake Michigan	A-CWT	Spring yearling 1+
	29,188	Lake Michigan	None	Fall fingerling 0+
2008	56,697	Lake Michigan	None	Spring yearling 1+
	10,813	Lake Michigan	A-CWT	Spring yearling 1+
	11,369	Lake Michigan	None	Fall fingerling 0+

Table A-3. Number of steelhead stocked in the Root River during 1994 – 2008. Stocking targets were 35,000 per strain, reduced to 27,000 chambers creek and ganaraska after 1998.

Year stocked	Total number	Strain	Fin clip
1994	30,417	Skamania	RM
	35,124	Chambers Creek	LM
	34,759	Ganaraska	LV
1995	37,347	Skamania	ARM
	37,819	Chambers Creek	ALM
	34,494	Ganaraska	ALV
1996	34,254	Skamania	RM
	34,579	Chambers Creek	LM
	35,404	Ganaraska	ARV
1997	35,262	Skamania	RMRV
	35,024	Chambers Creek	LMLV
	35,201	Ganaraska	BV
1998	37,484	Skamania	ARM
	33,187	Chambers Creek	ALM
	33,548	Ganaraska	ALV
1999	35,528	Skamania	RM
	26,951	Chambers Creek	LM
	26,963	Ganaraska	ARV
2000	37,010	Skamania	RMRV
	27,287	Chambers Creek	LMLV
	27,118	Ganaraska	BV
2001	35,247	Skamania	ARM
	27,060	Chambers Creek	ALM
	27,100	Ganaraska	ALV
2002	33,634	Skamania	RM
	27,064	Chambers Creek	LM
	27,125	Ganaraska	ARV
2003	35,448	Skamania	RMRV
	27,123	Chambers Creek	LMLV
	27,150	Ganaraska	BV
2004	35,145	Skamania	RM
	31,039	Chambers Creek	LM
	27,881	Ganaraska	ALV
2005	35,930	Skamania	ARM
	27,058	Chambers Creek	ALM
	27,975	Ganaraska	ARV
2006	34,452	Skamania	RMRV
	27,398	Chambers Creek	LMLV
	26,948	Ganaraska	BV
2007	35,210	Skamania	RM
	22,890	Chambers Creek	LM
	35,044	Ganaraska	ALV
2008	34,556	Skamania	ARM
	24,839	Chambers Creek	ALM
	22,789	Ganaraska	ARV